

THE MINERAL INDUSTRY OF MICHIGAN

This chapter has been prepared under a Memorandum of Understanding between the U.S. Bureau of Mines, U.S. Department of the Interior, and the Geological Survey Division, Michigan Department of Natural Resources, for collecting information on all nonfuel minerals.

In 1996, for the second consecutive year, Michigan ranked ninth in the Nation in total nonfuel mineral production value,¹ according to the U.S. Geological Survey (USGS). The estimated value for 1996 was more than \$1.5 billion, virtually unchanged from that of 1995. This followed about a 2.7% increase from 1994 to 1995 (based on final 1995 data). The State accounted for nearly 4% of the U.S. total nonfuel mineral production value.

Michigan continued to be a major iron ore-producing State, second only to Minnesota. Iron ore was the State's leading commodity by value, followed by portland cement. The value of mine shipments of iron ore from the State's mines increased significantly. Large gains also occurred in the values of magnesium compounds and portland cement while there were smaller, yet significant, increases in those of construction sand and gravel and crushed stone. Other mineral commodities that increased in value included masonry cement, gypsum (crude), potash, iron oxide pigments, and dimension stone. Most of these gains were offset by decreases in other nonfuel mineral values, resulting in nearly the same total value for both 1995 and 1996. The most significant portion of the decreases resulted from the cessation of copper and silver mine production in the State and from the drop in the value of salt. In addition, the values of lime, bromine, and industrial sand and gravel moderately decreased; lesser decreases occurred for peat and common clays.

Compared with USGS estimates of the quantities produced in the other 49 States in 1996, Michigan remained first in magnesium compounds and iron oxide pigments; second in iron ore, industrial sand and gravel, bromine, and peat; third in construction sand and gravel; tied for fifth in gypsum; and seventh in masonry cement. The State rose from fourth to third in portland cement and potash and was a significant producer of crushed stone, lime, and common clays. Michigan dropped from fourth to fifth in the Nation in the manufacture of raw steel with an estimated output of more than 6.6 million metric tons² (7.3 million short tons), as reported by the American Iron and Steel Institute.

The following narrative information was provided by the Michigan Department of Natural Resources (MDNR), Real Estate Division (RED).³ Late in 1996, the RED revised the metallic minerals leasing policy for State-owned mineral lands. The revised policy allows the State the option to direct lease metallic mineral rights when it is in

the State's best interest to do so. This will allow quicker leasing, and applications may be submitted at any time. By yearend, several applications for direct leases had been received, and the review process had begun.

The MDNR reviewed the policy on sand and gravel extraction from State-owned lands. Specific nonmetallic mineral leases were proposed for some large, busy pits; while special use permits would continue to be used on the smaller ones. Fees were proposed to help cover costs associated with the process.

The Michigan Department of Environmental Quality (MDEQ), Geological Survey Division (GSD), proposed to abolish the Mine Reclamation Act at a public hearing in East Tawas. The act, which covers solid rock, open pit mines, and quarries, has no funding, weak rules, and seldomly has been enforced since the early 1980's. Environmental groups and mining companies requested that the State remain involved in mine reclamation so there would be consistency across the State, but the matter was left undecided.

Regarding mineral exploration in the State, two exploration plans were approved for existing State metallic mineral leases, while several older leases were surrendered by companies as they changed areas of interest. Metallic mineral exploration drilling was at a standstill. The GSD reported that no such holes were drilled during the year.

The GSD's statewide Geological Core and Sample Repository at Marquette again received materials from throughout the State in 1996. Two companies provided 170 boxes of materials from 15 mineral exploration drill holes. Oil and gas well samples were received from 14 companies for 103 wells. The GSD also has a large oil and gas sample collection in Lansing. A collection of selected Upper Peninsula water well samples were maintained by the MDNR RED geologist at Escanaba. These collections are open to the public by appointment.

Bitterroot Resources Ltd. of Canada announced an agreement with Copper Range Co. to acquire their mineral rights to about 26,000 hectares of Michigan's Upper Peninsula. At the same time that airborne and surface explorations were begun, Bitterroot also announced agreements to lease additional lands from other owners for mineral exploration. Crystal Exploration Inc., owned by Pathfinder Resources Ltd. of Canada, closed their diamond exploration project and Crystal Falls office this year. Previous to this, their last partner, Ashton Mining of

Canada Inc., left the project.

As part of Kennecott Exploration Co.'s worldwide restructuring, the company closed its Crystal Falls office. Exploration will continue in Michigan by the Kennecott staff, which was relocated to North Carolina.

McKanna Mines & Minerals Co. of Hancock performed some initial exploration work on a known chalcocite vein in the upper level of the old Champion copper mine at Painsdale. Exploration efforts were expected to resume soon.

Minerals Processing Corp. of Champion was planning an exploration program for its land holdings in the State. The company also was custom-processing at its mill located at the old Humboldt iron mine.

A team of USGS geologists presented a paper at the fall 1996 Geological Society of America annual meeting entitled "Potential for Magmatic Ni-Cu Deposits in the Midcontinent Rift—A New Look Based on Voisey Bay and Noril'sk," in which they made reference to two areas in Michigan. In the abstract it was stated "We suggest that in the Lake Superior region good potential exists for magmatic Ni-Cu deposits in the ... Yellow Dog peridotite and Echo Lake gabbro in Michigan." State minerals officials anticipated that this may increase exploration efforts in the State.

Cleveland Cliffs Iron Co. (CCI), owned by Cleveland Cliffs Inc., operated Michigan's two iron mines, the Empire and the Tilden. These large open pit Marquette County mines were expected to produce 7.4 million and 5.8 million tons of ore and pellets, respectively, in 1996. The Empire produced magnetite ore and shipped both plain and fluxed pellets along with a small amount of siliceous iron ore. The Tilden mined both magnetite and hematite ores and shipped plain and fluxed pellets. Both mines shipped most of their product by rail to either Marquette or Escanaba for loading onto Great Lakes vessels for delivery to users, but a small portion of their production was sent to its final destination by rail.

In July, CCI applied to the MDEQ for approval to build another iron tailings basin for the Tilden Mine. The proposed 486-hectare impoundment would add 30 more years of tailings' capacity for the mine. The application was still under review at yearend. Tailings, the fine rock particles left after the iron minerals have been removed from the crushed ore, settle and accumulate in the basin; the process water is reused.

CCI announced the permanent closing of the Republic Mine, Republic, Marquette County. This open pit iron mine has been idle since 1981. Mining started in the Republic area in 1871. CCI operated the original mine from 1914 to 1937. In the 1950's, they reopened the mine and built a pellet plant in 1964. From 1956 to 1981, about 57 million tons of pellets were produced from Republic's ore. Reclamation of the mine area was in the planning stage and the plans have yet to be finalized.

Early in October, CCI announced the sale of their Ishpeming maintenance facility and some equipment to Malton Industrial Services Co. Malton will open a service center and supply some services to CCI's mines as well as other clients. Selected remaining operations were moved by CCI to the Empire and Tilden mine locations.

INMET Mining Corp.'s Copper Range Co. applied to the MDEQ for permits to convert parts of their idle White Pine underground copper mine to a solution mining operation. After 2.5 years of review, the MDEQ issued the required permits for full-scale solution mining in May 1996. In June, a Wisconsin Central Ltd. railroad shipment of acid for White Pine's mining project was delayed by residents near a train bridge in northern Wisconsin. The tracks were blocked again in July to prevent acid deliveries to White Pine, halting efforts to solution-mine the residual copper. Alternate shipping routes for the liquid were considered. Eventually, nonacid shipments resumed. In October, the United States Environmental Protection Agency (EPA) announced that they were starting a review of the solution-mining process. EPA had earlier declared it a State issue and had openly approved it. On October 14, 1996, Copper Range announced that it could not wait the anticipated 12 to 18 or more months for an EPA decision and were shutting down the pilot-scale solution-mining project. At yearend, EPA conducted a review. Copper Range continued to refine copper anode on a toll basis for a Canadian smelter at its White Pine refinery. Thus, a handful of jobs remained at White Pine where nearly 1,000 existed until September 1995. Full-scale solution mining could result in the creation of 200 to 300 jobs.

Red Metal Minerals Co., Hubbell, continued small scale-mining operations at the old Caledonia Mine near Mass in Ontonagon County. Native copper and related minerals were produced for sale to collectors and museums worldwide.

A number of limestone and dolomite quarries operated around the State. Aggregate, fluxstone, and raw material for cement manufacturing were several of the many products produced. Specialty Minerals at Port Inland, Michigan Limestone Operations at Calcite and Cedarville, Osborne Materials Co. at Drummond Island, and the Presque Isle Corp. at Stoneport supplied material for the fluxed iron ore pellets produced at the Empire and Tilden mines in 1996.

Cargill Inc. announced its purchase of the North American salt production, processing, and marketing operations of Akzo Nobel Salt Inc. The purchase included an evaporated salt operation at St. Clair.

Hart Packing Co. and Sargent Sand Co. both abandoned industrial sand production sites. Hart planned to reclaim a former sand dune mine site adjacent to Silver Lake State Park, Oceana County, and to expand the operation in Mackinac County, which was owned by their

related company. Sargent Sand was expected to abandon property it owned within the Ludington State Park, Mason County.

There were several developments related to previously closed mines and mining areas. Michigan's Abandoned Underground Mine Inventory Project entered its second year. The project was financed by a 2-year, \$200,000 State legislative appropriation. A professor at the Department of Mining Engineering of the Michigan Technological University, Houghton, was the contractor. Mine shafts and openings, surface subsidence, and near surface underground openings for more than 400 mines were to be indicated on maps compatible with the State geographical information system. Locations were to be ranked for safety needs, such as shaft capping and fencing of other openings. Public safety and local planning will benefit from this inventory. Stockpiles of usable byproducts, historical buildings, or potential uses for the sites were also to be noted. Cooperation of companies, county mine inspectors, local agencies, and all interested parties were requested to make the end product as useful and accurate as possible.

Surface subsidence, or caving, was a potentially dangerous feature around some of Michigan's abandoned underground mines. Caving at an abandoned mine was reported in the spring at Amasa, Iron County. An opening about 12 meters in diameter and about 27 meters deep to bedrock suddenly appeared a short distance from several homes. Safety fencing was installed by the county mine inspector.

The Quincy Mine Hoist Association, Hancock, started construction of a hillside tramway to take tourists from the hoist area down to the Quincy copper mine adit for mine tours. The tramway was being constructed where there was a tramway to haul copper and workers many years ago. Construction was to be completed in 1997.

The historic Cliffs Shaft Mine complex in Ishpeming was being considered for conversion to a tourist attraction by a nonprofit group. This iron mine was operated by

Cleveland Cliffs Iron Co. from 1881 until about 30 years ago. Three distinctive shaft houses and other buildings were included in the proposed project, which will stress the importance of mining and its history to the area.

Wisconsin Central Transportation Corp. acquired the Escanaba ore dock and railroad lines in Michigan and Wisconsin from the Union Pacific Railroad Co. The purchase included the line from the Empire and Tilden iron ore mines to the Escanaba ore dock on Lake Michigan. They also were to continue to haul mine tailings from the closed Republic iron mine to the dock for shipment to the LaFarge Corp.'s cement plant at Alpena, MI. The Union Pacific bought the Chicago & Northwestern Railway (C&NW) properties in 1995. The C&NW had operated ore shipping facilities at Escanaba since 1864.

¹The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1996 USGS mineral production data published in this chapter are estimates as of February 1997. For some commodities (e.g., construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Call MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset, and request Document # 1000 for a telephone listing of all mineral commodity specialists, or call USGS information at (703) 648-4000 for the specialist's name and number. This telephone listing may also be retrieved over the Internet at <http://minerals.er.usgs.gov/minerals/contacts/comdir.html>

²All tons are metric tons unless otherwise specified.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MICHIGAN 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1994		1995		1996 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	235	17,700	229	16,700	247	18,100
Portland	5,160	331,000	5,400	361,000	5,580	373,000
Clays	1,150	3,370	623	3,430	647	3,390
Gemstones	NA	2	NA	2	NA	W
Gypsum (crude)	1,790	15,300	1,510	14,900	1,360	15,300
Iron ore (usable)	13,800	W	13,500	W	W	W
Lime	637	33,000	653	34,600	484	25,300
Peat	156	5,090	173 3/	5,510 3/	168 3/	4,500 3/
Sand and gravel:						
Construction	48,800	160,000	53,500	178,000	54,400	185,000
Industrial	2,870	31,300	2,940	30,600	2,820	27,500
Stone:						
Crushed	35,000	113,000	37,500	127,000	38,000	131,000
Dimension metric tons	147 4/	35 4/	W	W	W	W
Combined values of bromine, copper (1994-95), iron oxide pigments (crude), magnesium compounds, potash, salt, silver (1994-95), stone [dimension dolomite and sandstone (1995-96), dimension sandstone (1994)], and values indicated by symbol W	XX	761,000	XX	736,000	XX	725,000
Total	XX	1,470,000	XX	1,510,000	XX	1,510,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Data series changed to production beginning in 1995; prior years shipment data may not be comparable.

4/ Excludes certain stones; kind and value included with "Combined value" data.

TABLE 2
MICHIGAN: CRUSHED STONE 1/ SOLD OR USED BY PRODUCERS IN 1995, BY USE 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	18	\$73	\$4.06
Riprap and jetty stone	109	830	7.61
Filter stone	141	403	2.86
Other coarse aggregate	18	75	4.17
Coarse aggregate, graded:			
Concrete aggregate, coarse	4,130	10,200	2.48
Bituminous aggregate, coarse	803	3,010	3.75
Bituminous surface-treatment aggregate	156	883	5.66
Railroad ballast	48	252	5.25
Fine aggregate (-3/8 inch): Other fine aggregate			
Stone sand, concrete	8	114	14.25
Stone sand, bituminous mix or seal	566	1,560	2.75
Screening, undesignated	404	1,490	3.68
Other fine aggregate	W	W	3.51
Coarse and fine aggregates:			
Graded road base or subbase	1,870	7,720	4.14
Unpaved road surfacing	1,130	5,500	4.88
Crusher run or fill or waste	18	142	5.72
Other construction materials 3/	68	385	5.66
Agricultural: Agricultural limestone 4/	140	885	6.32
Chemical and metallurgical:			
Cement manufacture	6,040	12,000	1.98
Flux stone	3,340	12,400	3.73
Other miscellaneous uses 5/	3,280	10,700	3.26
Unspecified: 6/			
Actual	14,500	55,300	3.82
Estimated	766	2,830	3.69
Total	37,500	127,000	3.38

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."

1/ Includes calcareous marl, dolomite, limestone, marble, miscellaneous stone, sandstone, shell, and traprock.

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Includes drain fields.

4/ Includes other agricultural uses.

5/ Includes lime manufacture and sugar refining.

6/ Includes production reported without a breakdown by end use and estimates for nonrespondents.

TABLE 3
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1995, BY KIND 1/

Kind	1994				1995			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	24 2/	27,900 2/	\$90,000 2/	\$3.23 2/	21	29,200	\$97,500	\$3.35
Dolomite	6	6,810	22,200	3.25 r/	6	8,110	28,700	3.54
Traprock	1	19	43	2.26	1	13	26	2.00
Calcareous marl	2	W	W	3.58	2	W	W	4.08
Sandstone	3	W	W	2.91	2	W	W	13.20
Marble	--	--	--	--	1	W	W	3.00
Shell	--	--	--	--	1	W	W	6.68
Miscellaneous stone	1	W	W	1.40	1	W	W	1.40
Total	XX	35,000	113,000	3.23	XX	37,500	127,000	3.38

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes "limestone-dolomite," reported with no distinction between the two.

TABLE 4
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1995, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	W	W	166	716	W	W
Coarse aggregate, graded 3/	W	W	1,960	5,950	W	W
Fine aggregate (-3/8 inch) 4/	W	W	396	1,450	W	W
Coarse and fine aggregate 5/	W	W	633	2,530	W	W
Other construction materials 6/	3,370	6,660	22	128	2,940	5,230
Agricultural 7/	(8/)	(8/)	(8/)	(8/)	105	(8/)
Chemical and metallurgical 9/	(8/)	(8/)	(8/)	(8/)	1,190	(8/)
Unspecified: 10/						
Actual	3,680	13,200	7,130	26,300	3,660	15,700
Estimated	217	304	--	--	549	2,520
Total	10,000	26,400	19,100	62,100	8,430	38,300

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.

3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.

4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.

5/ Includes graded road base or subbase, unpaved road surfacing, and crusher run (select material or fill).

6/ Includes drain fields.

7/ Includes agricultural limestone and other agricultural uses.

8/ Withheld to avoid disclosing company proprietary data; included in "Total."

9/ Includes cement manufacture, flux stone, lime manufacture, and sugar refining.

10/ Includes production reported without a breakdown by end use and estimates for nonrespondents.

TABLE 5
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1995,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	6,410	\$25,100	\$3.91
Plaster and gunite sands	25	106	4.24
Concrete products (blocks, bricks, pipe, decorative, etc.)	301	1,070	3.54
Asphaltic concrete aggregates and other bituminous mixtures	4,600	18,000	3.91
Road base and coverings 2/	7,460	22,500	3.02
Fill	5,660	11,100	1.96
Snow and ice control	351	1,260	3.60
Railroad ballast	33	129	3.91
Filtration	69	488	7.07
Other	260	1,600	6.13
Unspecified: 3/			
Actual	16,600	56,500	3.41
Estimated	11,800	40,600	3.46
Total or average	53,500	178,000	3.34

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes road and other stabilization (cement and lime).

3/ Includes production reported without a breakdown by end use and estimates for nonrespondents.

TABLE 6
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1995,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	346	1,620	955	3,360	5,440	21,300
Asphaltic concrete aggregates and road base materials 3/	1,510	3,830	1,760	4,810	8,790 4/	31,900 4/
Fill	433	773	282	640	4,940	9,680
Snow and ice control	28	51	W	W	W	W
Railroad ballast	31	111	W	W	W	W
Other miscellaneous uses 5/	--	--	311	1,310	343	2,000
Unspecified: 6/						
Actual	--	--	988	3,250	15,600	53,200
Estimated	1,680	5,410	1,700	4,840	8,370	30,400
Total	4,020	11,800	6,000	18,200	43,500 4/	148,000 4/

W Withheld to avoid disclosing company proprietary data; included in "Total."

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes plaster and gunite sands.

3/ Includes road and other stabilization (cement and lime).

4/ Includes unspecified within all districts.

5/ Includes filtration and roofing granules.

6/ Includes production reported without a breakdown by end use and estimates for nonrespondents.